Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Section 68.4(a) of the Commission's Rules	)	WT Docket No. 01-309
Governing Hearing Aid-Compatible Telephones	)	RM-8658
	)	

SPRINT PCS COMMENTS

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Sprint Spectrum L.P. d/b/a Sprint PCS ("Sprint PCS"), submits these comments in response to the Commission's inquiry into whether the current exemption from the Hearing Aid Compatibility Act ("HAC Act") for commercial mobile radio services ("CMRS") remains appropriate.[1]

I. INTRODUCTION AND SUMMARY

The Commission's reexamination of the HAC Act exemption for mobile telephones is appropriate, given that Congress has directed the Commission to "periodically assess the appropriateness of continuing in effect the exemptions."[2] Nevertheless, Sprint PCS demonstrates below that the statutory requirements for removing the exemption are not yet satisfied. More fundamentally, however, removal of the exemption would not result in the desired end: compatibility between digital wireless handsets and hearing aids. Because of the numerous variables in-

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[1] *See Section 68.4(a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones,* WT Docket No. 01-309, RM-8658, *Notice of Proposed Rulemaking,* FCC 01-320 (Nov. 14, 2001), *summarized in* 66 Fed. Reg. 58703 (Nov. 23, 2001)("*Hearing Aid NPRM*").

[2] *See* 47 U.S.C. § 610(b)(2)(C). The HAC Act rather than Section 255 of the Communications Act govern the subject of hearing aid/digital handset compatibility, because the enactment of the Telecommunications Act of 1996 did not repeal the HAC Act. Section 610(C) of the 1996 Act provides that "[t]his Act . . . shall not be construed to modify, impair, or supersede Federal, State, or local law unless expressly so provided in such Act."

volved (*e.g.,* extent of hearing loss, level of immunity built-in a hearing aid), this is an area where there may be no one solution that can be deployed to solve the problem in all instances. The problem certainly will not be solved by a Commission declaration to "make it so," given that it lacks regulatory authority over several indispensable parties.

This is a subject where the public interest would be better served if the Commission shifted its focus from legal issues (*e.g.,* the presence of the statutory exemption criteria) to problem solving. In the end, the hearing aid/digital handset compatibility issue is a technical challenge, and as Mark Ross, one of the experts in this area has observed, "laws and intentions do not solve technical problems. That is up to the scientists and engineers and to the organizations they represent."[3]

Several preliminary observations merit brief mention at the outset. First, the subject of hearing aid/digital handset "compatibility" is very different from the compatibility issues between hearing aids and corded landline telephones. The Commission was able to make landline telephones "hearing aid compatible" through use of "internal means" by requiring that new telephones generate a magnetic field of sufficient strength to allow for the effective coupling with the telecoil ("T-coil") of a hearing aid.[4] In this regard, the HAC Act does not require landline phones be compatible with all hearing aids, but only with those aids that are "designed to be compatible with telephones which meet established technical standards for hearing aid compatibility."[5] It is also important to note that compliance with this corded phone compatibility stan-

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[3] Mark Ross, *Wireless Telephones and Hearing Aids: An Overview,* 12 JAAA 386, 289 (June 2001). JAAA is Journal of the American Academy of Audiology.

[4] *See* 47 C.F.R. § 68.316.

[5] 47 U.S.C. § 610(b)(1)(B).

dard does "*not* guarantee acceptable performance or interface compatibility under all possible operating conditions" because of "the wide range of customer apparatus and loop plant."[6]

Magnetic coupling is not the problem with hearing aids and digital phones, and the land-line solution will "not [be] effective for cellular phones for several reasons, the most prominent is that it does not address the interference problem."[7] Even if magnetic coupling was the problem, it would make no sense to require wireless phones to deploy a fix for a technology (T-coils) that is diminishing in use[8] — especially when the hard-of-hearing community finds the neck-loop accessory needed for this solution "difficult to use, inconvenient, and ineffective."[9] In Sprint PCS' view, and putting legalities aside, the real issue should be "usability" — people with hearing aids should be able to use digital wireless services without encountering audible interference (buzzing or other annoying sounds that disrupt a wireless conversation) and if possible, without the use of cumbersome accessories.

Second and as demonstrated in these comments, the solution to audible interference will necessarily requires the involvement of the hearing aid industry.[10] As one expert has stated, "to

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[6] *See* TIA Standard RS-504 at ¶ 2.1, incorporated by 47 C.F.R. § 68.316 (emphasis added).

[7] H. Steven Berger, *ANSI C63.19 Hearing Aid/Cellular Telephone Compatibility* n.2 (Spring 2001), *available at* www.ieee.org/organizations/pubs/news-letters/emcs/sprng01/stan_act.htm

[8] Today, 20% of all hearing aids include T-coils. *See Hearing Aid NPRM* at ¶ 20. In 1980, 54% of all hearing aids sold included a T-coil, and in 1985, 35% of all hearing aids sold included a T-coil. *See* S. REP. NO. 100-391 at 5 (1998).

[9] *See* Hearing Aid and Digital Wireless Phones Compatibility, Summary of July 2, 2001 Meeting, at 3 *appended to* CTIA Ex Parte, Docket No. 01-108 (Oct. 10, 2001). *See also* Brief Comments of Dan Harper, Docket No. 01-309 (Nov. 2, 2001)("Would you want to walk around with a neck loop hanging on you all day so you could use your cell phone?"); Brief Comments of Eileen Kosterich, Docket No. 01-108 (Aug. 6, 2001)("Now instead of grabbing the phone when it rings and putting it to my ear as I turn my T coil switch on, I have to grab the phone, tell whomever is on the other end to hold on, and I need to unravel my loop, throw it around my neck and plug in as I race for my T coil switch.").

[10] *See, e.g.,* Hearing Aid and Digital Wireless Phones Compatibility, Summary of July 2, 2001 Meeting, at 1, *appended to* CTIA Ex Parte, Docket No. 01-108 (Oct. 10, 2001)("Everyone agreed that both wireless and hearing aid manufacturers must work together to resolve implementation issues if consumers are to benefit.").

have acceptable performance, the immunity of the hearing aid must match the RF emissions present in the area of the telephone in which the hearing aid is being used":

> [C]ritical parameters must be identified and specifications developed that each equipment manufacturer will follow. In this way, the immunity of the hearing aids can be matched to the emissions of the telephone so as to deliver to the user the intended performance.[11]

Historically, the hearing aid and wireless industries operated independently of each other. However, and in part as a result of the Commission's 1996 Summit, the two industries have begun sharing information to the benefit of hearing aid users. The wireless industry has shared technical information so hearing aid manufacturers can build electromagnetic interference ("EMI") immunity into their aids,[12] and these vendors have begun producing some hearing aid models that appear to work effectively with digital wireless services.[13]

Finally, as Sprint PCS discusses in Part III below, there is a solution to the "compatibility" problem that is already available in the market: use of hearing aids that contain the proper shielding or other immunity techniques.[14] The issue that the federal government (but not the FCC) needs to address is whether it should require all hearing aids to be digital handset compatible, or whether it should instead educate the public so each consumer can make his or her own

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[11] H. Stephen Berger, *Hearing Aid and Cellular Telephone Compatibility: Working Words Solutions,* 12 JAAA 309-10, 311 (June 2001).

[12] A representative of the Hearing Industry Association noted recently that handset manufacturers "have and continue to work with hearing aid manufacturers in developing technical solutions." Hearing Aid and Digital Wireless Phones Compatibility, Summary of July 2, 2001 Meeting, at 4, *appended to* CTIA Ex Parte, Docket No. 01-108 (Oct. 10, 2001).

[13] *See, e.g.,* Levitt & Harkins, *Editorial: Digital Wireless Telephones and Hearing Aids: New Challenges for Audiology*, 12 JAAA (June 2001); Ross, *Wireless Telephones and Hearing Aids: An Overview,* 12 JAAA 286, 288 (June 2001).

[14] Congress has recognized that hearing aid manufacturers would play an important role in providing a solution to the compatibility issue. *See* Public Law No. 100-394, § 2(3)("Congress finds that . . . anticipated improvements in both telephone and hearing aid technologies promise greater access in the future."

purchase decision regarding the level of immunity that his or her hearing aid should contain.[15] (The current situation – no minimum requirements on hearing aid immunities *and* no customer education – obviously is not the preferred solution).

The problem here is that the FCC lacks regulatory authority over hearing aid manufacturers,[16] and the question of hearing aid/digital wireless "compatibility" is likely better addressed by the Food and Drug Administration ("FDA"), which possesses regulatory authority over hearing aid manufacturers.[17] The FDA is aware of the problem, having tested hearing aids and digital handsets some years ago.[18] Although the FDA stated that it would conduct "further tests" in order to develop "future hearing aid standards and guidances,"[19] Sprint PCS is not aware of such additional tests or standards.

Sprint PCS describes in Part II below the problem of audible interference and addresses some of the legal issues that the Commission raised in its *NPRM*. In the following sections, Sprint PCS identifies the major issues and some of the steps that should be taken. The average life span for hearing aids has been estimated to be four-to-five years.[20] Thus, the sooner concrete

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[15] A person purchasing a hearing aid with weak immunity should not be heard to complain when he or she later has difficulty using certain digital handsets. Consumers should have the requisite knowledge when they purchase their hearing aids.

[16] *See, e.g.,* S. REP. NO. 100-391, 100th Cong., 2d Sess. 10 ((June 21, 1988)(HAC Act "is not intended to extend the FCC's jurisdiction to the hearing aid industry.").

[17] The Center for Devices and Radiological Health ("CDRH") section of the FDA is responsible for ensuring that medical devices such as hearing aids are safe and effective. *See* www.fda.gov/cdrh/index.html. *See also* 21 C.F.R. § 874.3300. Sprint PCS is serving a copy of these comments on the Director of the CDRH.

[18] *See, e.g.,* FDA, *Electromagnetic Interference: Hearing Aids and Wireless Digital Telephone Interference, available at* www.fda.gov/cdrh/ost/rep97/ost1997ar26.html.

[19] *See* FDA, *Electromagnetic Interference (EMI) Testing of Medical Devices: Testing of Hearing Aid Interference from Digital Cellular Telephones, available at* www.fda.gov/cdrh/ost.emi.html.

[20] *See* H.R. REP. NO. 100, 100th Cong., 2d Sess. 4 (June 7, 1988)("Each aid lasts approximately five years."); National Acoustic Laboratories, *Assessment of Interference to Hearing Aids Used in Australia by CDMA Digital Mobile Phones,* at 3 (Aug. 13, 1999)(four years).

action is taken, the sooner more hearing aid wearers can enjoy of benefits of digital wireless services.

Three facts are known with reasonably certainty at this time: (1) there will be no "one-size-fits-all" solution; (2) the Commission lacks the expertise and necessary regulatory authority to attempt to solve the problem itself; and (3) improved immunities in hearing aids can minimize if not eliminate audible interference. The hearing aid/digital handset compatibility issue will not be resolved based on legal pleadings submitted before a single regulator. In the end, the only way the compatibility issue will be addressed effectively is if all involved parties — hearing aid users and researchers, audiologists, hearing aid manufacturers, handset manufacturers, digital network operators, and regulators — work together with a common mission.

II. RESOLUTION OF LEGAL ISSUES WILL NOT SOLVE THE COMPATIBILITY CHALLENGE

The *Hearing Aid NPRM* contains a basic flaw: it assumes that the "compatibility" issue can be resolved by addressing certain legal questions (*e.g.,* remove the current CMRS exemption) and by adopting certain implementation measures on handset manufacturers and wireless carriers (but not hearing aid manufacturers). Sprint PCS demonstrates below that consideration of these legal and implementation issues is premature, because these issues become relevant only if a solution is known. The only known solution to the compatibility issue is improving the immunity of hearing aids (*see* Part III), but the Commission lacks regulatory authority over hearing aid manufacturers.

A. There Are Numerous Variables That Determine Whether a Particular Hearing Aid User Will Encounter Audible Interference

The causes of audible interference experienced by some hearing aid users when using some digital handsets are complex. Some hearing aid users have no problems whatsoever in us-

ing digital wireless services, while other people encounter significant problems. As one noted Gallaudet researcher has stated:

> Are digital wireless telephones compatible with hearing aids yet? Unfortunately, the answer to this is question is not a simple "yes" or "no." . . . Interference does not occur for all combinations of digital wireless telephones and hearing aids. . . . If you haven't already and want to take to plunge into the digital wireless telephone world, do it. You may find that interference does not occur with your hearing aid and the digital wireless phone you select. If you do experience interference, there are a number of potential solutions that probably will require some degree of trial and error . . . .[21]

The challenge is actually more vexing and puzzling. Hearing aids are often custom fit to the individual, and studies have shown that even identical aids (same manufacturer and model) can provide different immunity and produce different interference from the same phone exposure.[22]

What makes the "compatibility" issue so complicated is that there are so many different variables that will determine whether a hearing aid user encounters audible interference and if so, the level of the interference. As discussed in Appendix A, variables include the hearing loss of the hearing aid user, the design, technology and built-in immunity of the hearing aid, the digital technology used by the handset (*e.g.,* TDMA vs. CDMA), the design of the digital handset, and the precise area around the head where a hearing aid user places the digital handset. The discussion in Appendix A demonstrates that the Commission does not have the requisite tools to address this issue effectively.

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[21] Linda Kozma-Spytek, *Digital Wireless Telephones and Hearing Aids: Are They Compatible Yet?* (Dec. 2000), *available at* www.shhh.org/journal/featart.cfm. *See also* Harkins, *Practical Information for Audiologists on Access to Wireless Telephones* 12 JAAA 290, 293 (June 2001)("It should be noted that some hearing aid wearers will not experience bothersome interference at all.")

[22] *See Investigation of the Interaction Between CDMA Wireless Phones and Hearing Aids,* EMC Report 1999-1, at 4 (March 1999), *citing* Schlegel, Srinivasan, Grant, Shehab and Raman, *Clinical Assessment of Electromagnetic Compatibility of Hearing Aids and Digital Wireless Phones,* Human Factors and Ergonomics Society (1998).

B. There Is No Factual Basis to Revoke the Current Exemption Given the State of Current Technology and Knowledge

Congress has exempted wireless handsets from the Hearing Aid Compatibility Act, but has directed the Commission to reexamine this exemption periodically.[23] Congress has also specified the circumstances under which the Commission may revoke this exemption. Among other things, the Commission must find that compliance with the Act is "technologically feasible" and that the increased costs of any solution would not preclude the "successful marketing" of the handset.[24] Of course, the increased cost/successful marketing criterion cannot be addressed without first knowing the precise technical solution that would need to be implemented for compliance. At this point in time, Sprint PCS clearly cannot respond to the FCC's request that "[i]ndustry parties should address the extent to which costs would be increased and at what point such cost increases would begin to affect the marketability of covered telephones."[25]

At present, there is no known step or two that handset manufacturers could universally implement that would ensure compatibility between all digital handsets and hearing aids. What is known, however, is that digital handsets (which actually function as sophisticated radios) must emit radio frequency (RF) in order to make and receive calls. Indeed, digital handsets are designed to emit RF within FCC parameters. Thus, any solution must stop short of affecting the handset's ability to operate within these authorized parameters.

Nor does there exist (at least to Sprint PCS' knowledge) "empirical data . . . concerning the technological feasibility of making wireless telephones hearing aid compatible."[26] The hard-

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[23] *See* 47 U.S.C. § 610(b)(2).

[24] *See id.* at §§ 610(b)(2)(C)(iii) and (iv).

[25] *Hearing Aid NPRM* at ¶ 28.

[26] *Id.* at ¶ 24.

of-hearing community recognizes that additional research is needed,[27] and the studies referenced in these comments confirm that considerable effort is being made in this area.[28]

As noted above, there are numerous variables that will determine whether a particular hearing aid wearer will encounter audible interference with a particular handset. Until this subject is better understood, the Commission cannot reasonably conclude that it is technically feasible for handset manufacturers (much less, wireless network operators) to comply with the Hearing Aid Compatibility Act. There is, therefore, no basis in law for the Commission to remove at this time the statutory exemption of mobile telephones from the requirements of the Act.

C. Removing the Exemption Will Not Solve the Problems in Any Event

The revocation of the mobile telephone exemption would not result in a solution to the problem, as some appear to believe. As the Commission has recognized, compliance with the Act can occur only if there exist technical standards governing wireless-hearing aid compatibility.[29] In this regard, the Act specifically requires that subject phones provide an internal means for effective use with "hearing aids that are designed to be compatible with telephones which meet established technical standards for hearing aid compatibility."[30] There are, of course, technical standards governing the emissions of digital handsets, but there are no technical *interface* standards between such handsets and hearing aids.[31]

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[27] *See id.*

[28] *See, e.g.,* Levitt & Harkins, *Digital Wireless Telephones and Hearing Aids" New Challenges for Audiology,* 12 JAAA 274 (June 2001)(noting "several important developments" since 1995); Berger, *Hearing Aid and Cellular Telephone Compatibility: Working Towards Solutions,* 12 JAAA 309, 313 (June 2001) ("Significant advances have been made on each of these fronts.").

[29] *See Hearing Aid NPRM* at ¶ 16 (The statute "requires the establishment of *technical standards* governing wireless-hearing aid compatibility.")(emphasis in original).

[30] 47 U.S.C. § 610(b)(1)(B).

[31] *See Hearing Aid NPRM* at ¶ 7.

Congress has empowered the Commission to "establish or approve such technical standards as are required to enforce this section."[32] The record evidence before the Commission is inadequate for it to establish one or more standards that would solve the problem.[33] The Commission suggests that it could "require" industry to develop compatibility technical standards.[34] The weakness with this approach is that industry would face the same problem that the Commission would encounter if it attempted to adopt a standard directly: sufficient facts do not exist to develop a handset standard that would fix the diverse compatibility issues.[35] (As discussed below, development of a hearing immunity standard is a much more promising solution.)

Finally, even if the Commission or industry could divine the "correct" solution, the adoption of such an interface standard would be of no help to the millions of people currently using hearing aids. Congress has determined that the Commission may not require the retrofitting of existing telephones.[36] Thus, even assuming that hearing aid and handset industries could develop compatibility standards in two years, and further assuming that handset and hearing aid vendors would thereafter need 18-24 months to modify their equipment to comply with the stan-

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[32] 47 U.S.C. § 610(c).

[33] The Commission's statement that the record developed to date contains only "a high level of detail on this issue" (*Hearing Aid NPRM* at ¶ 27) is generous. Sprint PCS is not aware of any record evidence suggesting that there is a step that handset manufacturers or CMRS carriers could implement to solve the compatibility issue.

[34] *See Hearing Aid NPRM* at ¶ 16.

[35] Moreover, as the controversy over the U.S. ANSI standard demonstrates, it will be important to develop global standards.

[36] *See* 47 U.S.C. § 610(f)("[T]he Commission may not require the retrofitting of equipment to achieve the purposes of this section."). *See also* H.R. Rep. No. 100-674, 100th Cong., 2d Sess. 7 (June 7, 1988)("The law only applies to new telephones. The bill does not require any existing telephones to be retrofitted – in fact, present law prevents the FCC from requiring retrofitting of telephones other than emergency telephones.").

dards, it may be year 2006 at the earliest before standards-compliance handsets and hearing aids would become available in the market.[37]

In summary, (a) no factual basis exists for the Commission to conclude that it is technically feasible for handset manufacturers to modify their handsets so they are more compatible with hearing aids; (b) in any event revocation of the handset exemption will not result in wireless-hearing aid compatibility because technical interface standards do not exist; (c) appropriate standards cannot be developed until there exists a better grasp of the problem; and (d) even if standards could be developed, it will be years before standards-compliant handsets and hearing aids could become commercially available.

III. THERE IS A KNOWN AND AVAILABLE SOLUTION TO THE PROBLEM AT LEAST FOR CDMA HANDSETS: ENSURE THAT HEARING AIDS INCLUDE SUFFICIENT IMMUNITY

Studies have confirmed that hearing aids can work with CDMA handsets if the hearing aids contain sufficient immunity. In 1998, the CDMA Development Group commissioned the Center for the Study of Wireless Electromagnetic Compatibility at the University of Oklahoma ("EMC") to investigate the interaction between CDMA handsets and hearing aids.[38] EMC tested four CDMA phones (800 and 1900 MHz from two manufacturers) with nine hearing aids from four different manufacturers (both in-the-ear and behind-the-ear aids). EMC chose six hearing aids that earlier studies had demonstrated high susceptibility to audible interference and three

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[37] Hearing aid wearers generally encounter no difficulties with analog AMPS service. *See* Appendix A. The FCC is currently considering a proposal to remove the requirement that cellular licensees provide AMPS service. *See Elimination of Outdated Rules Affecting the Cellular Radiotelephone Service,* Docket No. 01-108, 16 FCC Rcd 11169 (2001). Because of the importance of AMPS service to persons using hearing aids, the FCC may want to include the pleadings filed in this proceeding in the AMPS rulemaking record in determining an appropriate phase-out period for mandatory AMPS service.

[38] *See Investigation of the Interaction Between CDMA Wireless Phones and Hearing Aids,* EMC Report 1999-1 (March 1999)("EMC CDMA Study"). The CDMA Development Group, of which Sprint PCS is a member, is an international consortium of companies that have joined together to lead the adoption and evolution of CDMA wireless systems around the world. *See* www.cda.org.

aids with better immunity.[39] The tests confirmed that the immunity of individual hearing aids has an enormous impact on whether a hearing aid user will encounter interference:

> Observation of the ambient noise floor and the saturation region depends on the range of power levels tested in relation to the immunity of the hearing aid. ***Aids with very poor immunity may demonstrate interference even at the lowest power level tested. Aids with good immunity may demonstrate little interference even at high power levels*** (see Figure 8), certainly not enough interference to observe saturation.[40]

Specifically, the tests demonstrated that users of the three hearing aids with high built-in immunity would generally encounter no audible interference with CDMA handsets.[41]

Scientists with the Australian National Acoustic Laboratories have stated that hearing aids can be made immune using "reasonably simple techniques," including the use of "more compact circuitry, the addition of shunting capacitors, and the use of various types of electrostatic shielding":

> Currently, it is not difficult to improve the immunity of hearing aids operating in microphone mode by well-recognized techniques, making it possible to reduce interference to an acceptably low level, even below the hearing aid electrical noise level.[42]

It appears that hearing aid immunity standards have already been established in Australia.[43] Released in 1996, AS1088.9(C2) is designed to enable a hearing aid wearer to "use a hand-

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[39] *See id.* at Appendix A, Hearing Aid Selection.

[40] *Id.* at 14 (emphasis added).

[41] *See id.* at Figures 8, 12, 16 and 20.

[42] Byrne and Burwood, *The Australian Experience: Global System for Mobile Communications Wireless Telephones and Hearing Aids,* 12 JAAA 315, 320, 321 (June 2001). There are two general techniques to increase the immunity of a hearing aid to EM interference. "The first is to reduce the level of EM energy reaching the critical circuit components. The second is to balance the EM energy across critical circuit components." Levitt, *The Nature of Electromagnetic Interference,* 12 JAAA 322, 325 (June 2001).

[43] Sprint PCS is here referring to standards designed to enable wearing aid wearers to use digital handsets – standards addressing "user interference." Europe has adopted standards to prevent "bystander interference" (so a person is not inconvenienced by another's use of a digital handset), but Sprint PCS is not

held digital mobile phone themselves without interference."[44] According to the Australians, use of a hearing aid that complies with this standard "would eliminate interference associated with the use of digital mobile phones in all environments" — including, apparently, GSM mobiles.[45] However, for reasons not known, the Australian government has not required hearing aid manufacturers to comply with this "Class C2" immunity standard.[46]

Nevertheless, without rules, regulations or technical standards, hearing aid manufacturers have already begun to introduce some high-immunity/digital handset compatible hearing aids in the market.[47] For example, one large manufacturer, Oticon, states on its web page:

> Oticon hearing instruments (such as DigiFocusII, Digilife.com, Ergo and Swift) use a special, built-in "safety shield" against cellular interference and provide excellent protection against electrical disturbance.[48]

Hearing aid organizations have recommended that consumers consider purchasing high immunity hearing aids because they provide "effective protection against potential interference from mobile phone signals."[49]

Thus, given that there is a solution for CDMA handsets (and according to the Australians, for GSM handsets as well), Sprint PCS submits that the inquiry should focus on developing im-

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aware of any E.U. requirements addressing "user interference." *See, e.g.,* Bisgaard, *The European Experience,* 12 JAAA 296 (June 2001).

[44] Australian Human Rights and Equal Opportunity Commission, *Report of Inquiry: Mobile Phones and Hearing Aids,* Appendix A at 38 (July 2000).

[45] *Id.* at 41.

[46] *See id.* at 38.

[47] *See* Berger, *Hearing Aid and Cellular Telephone Compatibility: Working Toward Solutions,* 12 JAAA 309, 313 (June 2001).

[48] *See* http://www.oticon.com/eprise/main/Oticon/com/SEC_HearingAidUsers/WearingHearingInstruments/REUSE02_HearingAidsAndPhones.

[49] *See* Northern Virginia Resource Center for Deaf and Hard of Hearing Persons, *Digital Wireless Phones/Hearing Aids* (July 2, 2001), *available at* www.nvrc/shhh_conference_10.htm.

munity standards for hearing aids. Again, this suggests that the FDA – not the FCC – should initially address the compatibility issue.

IV. THE COMMISSION DOES NOT HAVE THE TOOLS TO ADDRESS EFFECTIVELY THE TWO MOST IMPORTANT COMPATIBILITY ISSUES

Establishing hearing aid/digital handset interface compatibility standards is important. But as noted above, even if such standards can be adopted, products incorporating the standards would not be available for several years, thereby providing little relief to today's hearing aid wearers. The wireless industry and the hearing aid community have developed a measurement standard in the hope of helping consumers purchase a handset that is compatible with a hearing aid (or *vice versa*), but questions have surfaced with this standard. As discussed below, the Commission does not possess the tools (*e.g.*, regulatory authority, resources, expertise) to address these issues on its own.

A. Questions Have Been Raised With the New Measurement Standard

One of the most challenging practical problems hearing aid users face today is finding a particular digital handset that works best with their particular hearing aid. Experience shows that some handsets work better than others for users of particular hearing aids. However, other than trial-and-error and word of mouth, there is no readily available information that hearing aid users can consult in order to determine which handsets might work best for them.[50] It would appear that the interests of hearing aid wearers would be enhanced significantly if objective information concerning the pairing of particular handsets with particular hearing aids were readily available.

[50] Network operators like Sprint PCS do not have the expertise with hearing loss and hearing aids to make particular handset recommendations to hearing aid users.

Industry and the hard-of-hearing community have devoted considerable time and resources in developing a comprehensive testing/measurement standard so that particular hearing aids could be paired with particular digital handsets.[51] The resulting standard, ANSI C63.19-2001, was approved earlier this year.[52] The standard specifies certain tests to be performed on handsets and hearing aids, and it includes a rating system so consumers can pair particular hearing aids with particular digital handsets.[53]

Unfortunately, the new ANSI standard has faced certain obstacles. First, the U.S. standard (ANSI C63.19) is different than the measurement standard adopted in Europe (International Electromechanical Commission, IEC 60118-13). For example, the U.S. standard measures "near field" RF radiation while the European standard measures "far field" RF radiation. Some experts in Europe have taken the position that the U.S. standard "appears flawed":

> The method of measurement of hearing aid immunity proposed in the ANSI standard relies on the use of a dipole to radiate the RF test signals. Measurements of E and H field components, made in accordance with the ANSI draft, resulted in large E field variations. . . . The magnitude of E field variations within the ANSI-defined hearing aid test area were such that an accurate specification of the interfering RF signal would not be possible. The recommendation is therefore that this [ANSI] method be abandoned as the basis for an IEC standard.[54]

Some Europeans have also criticized the ANSI rating/classification system because of the "problems inherent in measuring the parameters with sufficient accuracy could well lead to inappropriate classification of either device":

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[51] *See Hearing Aid NPRM* at ¶ 7 and ¶¶ 25-26.

[52] *See* Institute of Electrical and Electronics Engineers, *American National Standard for Methods of Measurement of Compatibility Between Wireless Communications Devices and Hearing Aids*, ANSI C63.19-2001 (Oct. 8, 2001).

[53] The ANSI standard places hearing aids into three categories (low, medium, high immunity) and mobile phones into three categories (low, medium and high emission). Hearing aids and mobile phones are then combined in classifications for "excellent performance," "normal use," and "usable."

> It is therefore proposed that while levels should be recorded for both radiation and immunity, no steps should be taken at classification.[55]

Regardless of validity of this criticism and regardless of which measurement standard is better, the fact remains that the incompatible American and European standards present a major problem for handset and hearing aid manufacturers, because their products are designed for the global market.[56]

Second, the ANSI standard has been criticized because the necessary instrumentation is so costly (*e.g.*, $25,000 to $50,000).[57] Some have taken the position that it is "not evident that it is necessary to use an expensive arrangement like this to evaluate the electromagnetic interference performance of a hearing aid."[58] Others have recommended that vendors use different measurement tests employing off-the-shelf equipment (*e.g.*, Radio Shack sound level meters, an inexpensive "boom box") that would instead cost $500.[59]

However, the most serious problem with the new ANSI measurement standard is that hearing aid manufacturers apparently have decided not to implement it. At a July 2, 2001 meeting of interested parties, a representative of the Hearing Industry Association ("HIA") stated that

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[54] Technical-Ideological Lab, *Hearing Aids and Mobile Phones Interference and Immunity Standards (HAMPIIS),* Technical Report TR-1 (1999), *available at* www.delta.dk/hampiis/report.htm.

[55] *See id.*

[56] The ANSI standard states that the European test is "an acceptable alternative for the hearing aid RF immunity test." ANSI C63,19-2001, Annex I at 91. However, consumers would realize little or no benefit if one set of vendors performed the U.S. tests while another set of vendors performed the E.U. tests. It is essential that all manufacturers conduct the same tests.

[57] *See* Killeen, Teder & Thoma, *Suitcase Lab Measurement of Digital Cellophane Interference Levels on Hearing Aids,* 12 JAAA 281 (June 2001).

[58] DELTA, Technical-Ideological Lab, *D1 Review of ANSI PC 63.19 Draft Standard,* at 3 (June 16, 1999).

[59] *See* Killeen, Teder & Thoma, *Suitcase Lab Measurement of Digital Cellphone Interference Levels on Hearing Aids,* 12 JAAA 281 (June 2001).

its members "have encountered problems with the repeatability of test results" using the ANSI C63.19 standard:

> Several hearing aid manufacturers have conducted tests using the standard to measure the immunity level between a specific digital wireless phone and a specific hearing aid within a product or model line. According to [HIA], each time they conduct the test, the result is a different level of immunity. [HIA] indicated that unless the tests can be repeated successfully with consistent test results, HIA members are not inclined to implement the standard as it exists or label their products accordingly.[60]

The HIA representative indicated that hearing aid manufacturers do "not want to be in a position of making claims to consumers regarding the immunity level of hearing aids when there is such uncertainty. This would only lead to customer confusion."[61]

Sprint PCS has no basis to question the testing "repeatability" problems that hearing aid manufacturers have encountered. However, it makes no sense for handset manufacturers to conduct ANSI measurement tests if hearing aid vendors are not performing the same tests.[62] As recognized at the July 2, 2001 meeting:

> The parties agree that both industries must implement [the] ANSI C63.19 standard concurrently if the standard is to be useful to the consumer.[63]

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[60] Hearing Aid and Digital Wireless Phones Compatibility, Summary of July 2, 2001 Meeting, at 2, *appended to* CTIA Ex Parte, Docket No. 01-108 (Oct. 10, 2001).

[61] *Id.* According to the HIA representative at this meeting, "the CEOs of the hearing aid companies had recently voted unanimously to make no claims on immunity while they dealt with the repeatability problem." *Id.*

[62] It clearly makes no sense for network operators/service providers to conduct such handset measurement tests. Individual network operators may not have the resources (*e.g.*, expertise, testing equipment) to conduct handset/hearing aid tests, and tests by network operators would not be efficient (since multiple carriers often use same handset in the provision of their respective services).

[63] Hearing Aid and Digital Wireless Phones Compatibility, Summary of July 2, 2001 Meeting, at 6, *appended to* CTIA Ex Parte, Docket No. 01-108 (Oct. 10, 2001). *See also id.* at 1 ("Several participants agreed that unless both industries are implementing the standard at the same time, the standard is virtually useless for consumers. Even if the wireless industry implemented the standard, and provided consumers with the relevant immunity level of the digital wireless phone, the number is meaningless unless there is a corresponding number for the hearing aid.").

Sprint PCS submits that the questions that have arisen with the ANSI measurement standard are not issues that the Commission can efficiently resolve. There is certainly no basis for the Commission to require handset manufacturers to undertake the ANSI or other measurement tests unless hearing aid manufacturers are subject to the same requirement, since tests by one industry but not the other would provide no value to consumers.

B. A More Permanent Solution Will Require the Cooperation of the Hearing Aid Industry

The conduct of "pairing" tests and the publication of the test results would constitute an important step forward. While pairing tests may begin providing important clues as to how hearing aids and/or digital handsets could be modified to enhance compatibility, such tests will not, in and of themselves, constitute a solution to the problem.

It appears to Sprint PCS that the most promising solution to the compatibility issue is to have hearing aid manufacturers build in sufficient immunity to their products so as to eliminate audible interference. If this is the case, hearing aid immunity standards may be an important next step (preferably, global standards). To repeat, however, the Commission lacks jurisdictional authority to develop hearing aid immunity standards, thus reinforcing the need to involve the FDA.

* * *

Several points are clear given the complexity of the hearing aid/digital handset compatibility subject: (1) solutions will not be found based on legal pleadings prepared by lawyers; (2) solutions will require the active participation and cooperation of all involved parties – including, hearing aid wearers, audiologists, hearing aid manufacturers, handset manufacturers and wireless

service providers; and (c) a global solution is needed.[64] It further appears to Sprint PCS that it is the FDA that should take the lead on this issue, because it has the requisite regulatory authority over hearing aid manufacturers.

V. THERE ARE CERTAIN STEPS THE COMMISSION CAN TAKE

Resolution of the hearing aid/digital handset compatibility issue will require a global effort involving all affected parties. Sprint PCS nonetheless believes that there are several steps that the Commission can take to facilitate the process: (a) prepare and publish a "consumer fact sheet" so hearing aid wearers can be more informed, particularly when they purchase hearing aids or digital wireless service, and (b) coordinate activities among other regulators, both within the U.S. (*e.g.,* FDA) and in other countries.

A. The Commission Should Publish a Consumer Fact Sheet So Hearing Aid Users Have Access to the Facts

A research audiologist in Gallaudet University's Technology Access Program has stated that "[h]earing aid candidates and wearers need to be more informed – about how wireless telephones work, the nature of the compatibility problem between hearing aids and digital cellular technology, and the options for accessible wireless communications."[65] A noted hearing consultant has similarly stated that the "research performed to date demonstrates that educated users

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[64] Both hearing aids and digital handsets are designed for the global market; consequently, the cost of design solutions can be more easily borne when spread across tens of millions of customers worldwide compared to the number of hearing aid users in a single country. Design solutions tailored for one country are therefore impractical and would ultimately harm consumers as they alone would bear the cost for unique design solutions.

[65] Linda Kozma-Spytek, *Digital Wireless Telephones and Hearing Aids: Are They Compatible Yet?* (Dec. 2000), *available at* www.shhh.org/journalfeatart.cfm.

can materially improve their situation."[66] Sprint PCS submits that the Commission can play an important role in a consumer education effort. Indeed, a Commission-published "fact sheet" would be far more credible than anything any a single manufacturer or network operator could prepare.

The Commission currently has a hearing aid web page (*see* www.fcc.gov/cib/dro/hearing.html), but the page provides access to FCC orders, public notices, and rules only — namely, "legal" information. What consumers and audiologists need is more practical information, including a description of the compatibility issue, available options, how hearing aid wearers might test digital services before purchase. In short, consumers and audiologists need information similar to the "News You Can Use" campaign that Commissioner Abernathy commenced recently.[67] Sprint PCS therefore encourages the Commission to revise its hearing aid web site to include more practical information that consumers would find of value.[68]

B. The Commission Should Coordinate Its Activities with the FDA and Regulators in Other Countries

Hearing aid manufacturers are an indispensable party to the current discussion because research indicates that hearing aid manufacturers offer the most promising solutions for hearing aid/digital handset compatibility. However, it is the Food and Drug Administration ("FDA"), not the FCC, which possesses regulatory authority over hearing aid manufacturers. The FCC has

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[66] Berger, *Hearing Aid and Cellular Telephone Compatibility: Working Towards Solutions,* 12 JAAA 309, 313 (June 2001).

[67] *See FCC News*, "Commissioner Abernathy Announced Improvements to Website" (Dec. 11, 2001).

[68] The Australian Communications Authority has published such a fact sheet, *see* "Guide for Consumers." *See* www.aca.gov.au/consumer/brochure/index.htm.

shared information with the FDA in the past,[69] and it should work with the FDA again, because it is more likely than not that hearing aid manufacturers will need to be included in any solution.[70]

The Commission should also coordinate its activities with regulators in other countries. Hearing aid/digital handset compatibility is not an issue confined to the U.S. Given that both hearing aids and digital handsets are manufactured for the global market, the problems encountered by American citizens are the same problems encountered by consumers in other countries. Some regulators, notably the Australian Communications Authority, have already devoted considerable resources to the subject. The Commission should take advantage of this work and expertise. In addition, a global solution needs to be developed given that hearing aids and handsets are designed and produced for the world market.

There is, however, no basis on which the Commission could lawfully impose new requirements on handset manufacturers, since there is no known solution that they could implement. And certainly, there is no basis for imposing a mandate on carriers at this time. If the Commission believes that further public discussions would be productive, it should explore the possibility of an ATIS-sponsored hearing aid forum (similar to the ATIS TTY Forum). Such a forum would allow the affected parties to identify the available steps that could be implemented to minimize or eliminate compatibility problems. Such a forum, however, would be successful only if all involved parties (including audiologists and hearing aid manufacturers) attended and participated.

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[69] *See, e.g.,* Letter from Reed E. Hundt, FCC Chairman, to Susan Golding, Mayor, City of San Diego, at 3 (March 15, 1996).

[70] Toward this end, Sprint PCS is serving the FDA with a courtesy copy of these comments.

VI. THE ACCESS BOARD'S CONCERNS ARE UNFOUNDED

The Architectural and Transportation Barriers Compliance Board ("Access Board"), in early filed comments, asks the Commission to "clearly explain that its ruling on the HAC exemption will NOT take precedence over the [Board's] Section 508 standards."[71] In fact, the Board's "Section 508 standards" have little relevance to this proceeding and in any event, Access Board regulations do not (and cannot) trump the statutory requirements contained in the Hearing Aid Compatibility Act.

Section 508 of the Rehabilitation Act Amendments of 1998 requires federal agencies that use electronic and information technology to provide disabled persons with access to such technology that is comparable to the access available to non-disabled persons, "unless an undue burden would be imposed on the department or agency."[72] The statute further directs the Access Board, "after consultation with . . . the Chairman of the Federal Communications Commission," to adopt implementing "standards" that will become part of the federal procurement regulations.[73] The Access Board adopted such standards in December 2000.[74]

The Access Board's Section 508 standards have little relevance to this proceeding. The Hearing Aid Compatibility Act applies to "telephones" and, therefore, extends to service providers and manufacturers of telephones.[75] Section 508 of the Rehabilitation Act, in contrast, applies to federal agencies rather than private parties. As the Access Board has recognized:

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[71] Access Board Comments, Docket No. 01-309, at 1 (Dec. 21, 2001)(capitalization in original).

[72] *See* 29 U.S.C. § 794d(a)(1)(A).

[73] 29 U.S.C. § 794d(a)(2)(A).

[74] *See Section 508 Standards Order*, 65 Fed. Reg. 80500 (Dec. 21, 2000). The standards are codified in 36 C.F.R. Part 1194.

[75] *See* 47 U.S.C. § 610.

> Q. Does section 508 require contractors to manufacture EIT [electronic and information technology] that meets the applicable Access Board's technical provisions?
>
> A. No. Section 508 requires the government to purchase EIT that meets the applicable technical provisions of the Access Board's standards, with certain exceptions. . . . Contractors (including manufacturers and designers) are under no obligation to consider either section 508 or the Access Board's standards if they do not wish to market their products to the Federal government.[76]

It is not apparent to Sprint PCS how a federal agency's compliance with Section 508 or the Access Board's implementing standards has any relevance to a telecommunications carrier/manufacturer's obligation under the Hearing Aid Compatibility Act.[77]

The Access Board further recommends that the Commission address the issue of hearing aid "compatibility" separately from hearing aid "interference."[78] According to the Board, "[t]raditionally, the HAC has referred only to effective magnetic coupling, not to minimizing interference."[79] Sprint PCS must respectfully disagree, because Congress made apparent that compatibility is synonymous with access, and for digital wireless services, audible interference is directly related to access.

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[76] *See* Access Board, Frequently Asked Question C.3, *available at* www.section508.gov/508QandA.html.

[77] The FCC should be aware that the Access Board's standards do not require what they literally state. For example, Standard 1194.23(i) specifies that federal agencies may only use wireless handsets whereby "[i]nterference to hearing technologies . . . shall be reduced to the lowest level possible that allows a user of hearing technologies to utilize" the handset. 36 C.F.R. 1194.23(i). The Board has nonetheless recognized that compliance with this requirement is not possible, and it has stated that "compliance with the ANSI C.63.19 [measurement standard] would meet this provision." *See* 65 Fed. Reg. at 80516. But in adopting this ANSI test alternative, the Board has failed to recognize that handset testing is of no value unless hearing aids are measured using the same standard.

[78] Access Board Comments at 2.

[79] *Id.*

The purpose of the HAC Act is set forth in the Act itself: "The Commission shall establish such regulations as are necessary to ensure *reasonable access* to telephone service by persons with impaired hearing":[80]

> The Congress finds that to the fullest extent made possible by technology and medical science, hearing-impaired persons should have equal access to the national telecommunications network. . . .[81]

The legislative history confirms that Congress did not, as the Access Board suggests, intend to limit the terms "reasonable access" and "compatibility" to magnetic coupling:

> The bill only requires that telephones be compatible; it does not mandate any particular type of technology. Induction coupling and electromagnetic fields are not even mentioned. . . . This [statutory] definition does not require induction as the sole method of telephone/hearing aid coupling. It is flexible and allows for other methods of compatibility.[82]

In Sprint PCS' judgment, the legal arguments advanced by the Access Board confirm that the Commission should focus on problem solving rather than resolving highly technical legal issues — because the hearing aid/digital handset compatibility issue will not be solved by resolution of any legal issue.

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[80] 47 U.S.C. § 610(a)(emphasis added).

[81] PUBLIC LAW NO. 100-394, 100th Cong., 2d Sess. § 2(1).

[82] H.R. REP. NO. 100-674, 100th Cong. 2d Sess. 8 and 12 (June 7, 1988). *See also* S. REP. NO. 100-391, 100th Cong., 2d Sess. 2 (June 21, 1988)("Telephones may also be 'compatible" without a telecoil. . . . It is also possible that other means of 'compatibility' may be developed in the future.").

VII. CONCLUSION

For the foregoing reasons, Sprint PCS recommends that the Commission take action consistent with the recommendations contained in these comments.

Respectfully submitted,

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Appendix A

THE HEARING AID/DIGITAL HANDSET COMPATIBILITY ISSUE DESCRIBED

Hearing aids are electronic devices that amplify sound for the benefit of those with limited hearing capabilities. The hearing aid microphone generates an electric signal from the input sound pressure level. This signal is amplified by the amplifier and then converted back to sound energy by the speaker.[83] If a hearing aid wearer comes into close proximity with an electronic device that emits radio frequencies (*e.g.,* TV, microwave oven, personal computer, digital handset), the possibility exists that the hearing aid microphone or circuitry within the hearing aid may pick up these emissions which, depending on the design of the hearing aid, may result in audible interference to the hearing aid user.

There was no compatibility/usability issue so long as both hearing aids and handsets used analog technologies (because analog radio transmissions are not pulsed and are generally of constant amplitude).[84] However, audible interference issues began surfacing as wireless carriers introduced digital service. (Hearing aid vendors have recently begun selling digital hearing aids.) Audible interference between digital handsets and analog hearing aids occurs when the hearing aid amplifier circuitry picks up (or demodulates) the RF bursts from the phone transition. The hearing aid wearer may be able to hear the amplified wireless signal as noise (e.g., a buzzing sound).[85]

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[83] If the hearing aid is equipped with a telecoil ("T-coil"), the acoustic microphone is disabled and a magnetic field signal, generated by the telephone, becomes the signal source. During T-coil operation, the magnetic field generated by the phone is intended to be the primary coupling mechanism to the hearing aid.

[84] *See Hearing Aid NPRM* at ¶ 7.

[85] *See Hearing Aid NPRM* at ¶ 7.

Whether a hearing aid user encounters audible interference depends on numerous factors, including those discussed below.

A. Type of Digital Technology. The type of potential for audible interference depends on the type of digital air interface used by the wireless service provider. Time Division Multiplexing Access ("TDMA")-based technologies (*e.g.,* GSM, iDEN, TDMA), are designed to generate high frequency signals (at 800 MHz or 1.9 GHz) that are switched on and off systematically so as to allow for several communications channels on a single carrier frequency. The most common TDMA systems interrupt the transmission either at 50 or 217 times per second. The hearing aid microphone picks up (or demodulates) the frequency of this interruption rate, which is in the audio frequency range. Depending on numerous other variables discussed below, these signals can produce an audible interference with a periodicity (heard as a buzz) equal to the rate of interruption and a very large number of harmonics covering the entire audio frequency range.

The CDMA technology used by Sprint PCS employs a very different and much more complicated digital coding technique. With CDMA, a form of spread-spectrum, each voice signal shares available spectrum in both time and frequency, with individual conversations sharing a wide (*e.g.,* 1.25 MHz) channel (or carrier). Each voice signal is distinguished from others through unique spreading codes assigned to each communications. Since there is no periodic interruption of the carrier wave, the nature of the potential electromagnetic interference is different from that of TDMA. The interference produced by CDMA does not have a strong periodic component, but it can have a broad frequency spectrum. Thus, as one hearing aid expert has observed, it is "very difficult to compare CDMA interference with TDMA interference."[86]

There is anecdotal evidence in the U.S. that hearing aid users have fewer problems with CDMA than TDMA handsets. One hard-of-hearing group has stated:

> There have been reports that CDMA technology causes less audible interference than others. While no study has yet proved this, throughout the conference there were several personal reports from people who had done well with CDMA technology.[87]

These reports were substantiated by a preliminary 1999 study conducted by the Australian National Acoustic Laboratories ("NAL").[88] NAL studied CDMA "clam" phones with the three most popular hearing aids used in Australia. NAL determined that 95% of persons using one of these hearing aids would encounter audible interference that is either "not perceptible" or "just perceptible."[89] This has led the Australian regulator, the Australian Communications Authority ("ACA"), to recommend that hearing aid consumers use CDMA rather than GSM handsets:

> CDMA is a new type of digital mobile phone technology that is suitable for use with most hearing aids. Trials have recently been conducted by the National Acoustic Laboratories to assess levels of interference on a typical range of hearing aids. Results indicate that most hearing aid users who can successfully us an analogue phone or a standard telephone will be able to use a CDMA phone without the use of accessory kits.
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> * * *
>
> Interference to hearing aids is likely to be experienced to a greater degree when a GSM digital phone is used. This may be reduced by using an accessory kit which

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[86] Mark Ross, *Wireless Telephones and Hearing Aids: An Overview,* 12 JAAA 286, 287 (June 2001).

[87] *See* Northern Virginia Resource Center for Deaf and Hard of Hearing Persons, *Digital Wireless Phones/Hearing Aids* (July 2, 2001), *available at* www.nvrc.org/shhh_conference_10.htm. *See also* Brief Comments of Elizabeth Stout, Docket No. 01-309 (Dec. 27, 2001)("The Sprint PCS [handset] is wonderful, good sound quality & volume.").

[88] *See* National Acoustic Laboratories, *Assessment of Interference to Hearing Aids Used in Australia by CDMA Digital Mobile Phones,* EB831 (Aug. 13, 1999)("NAL CDMA Study"). NAL is a division of Australian Hearing Services, an Australian Government Statutory Authority. The NAL conducted a similar study of GSM handsets in 1995. *See* NAL, *Interference to Hearing Aids by the Digital Mobile Telephone System, Global System for Mobile Communications (GSM),* Report No. 131 (1995). The results of the GSM study were not encouraging, and lead to the development of the Australian heading aid immunity standard discussed below.

[89] *See* NAL CDMA Study at 25. Sprint PCS states for the record that it is not sufficiently familiar with this NAL CDMA Study to endorse it.

allows for hands-free use so that the phone can be kept at a distance from the hearing aid.[90]

Sprint PCS wishes to emphasize that CDMA is not perfect in terms of the level of audible interference with hearing aids and the fact that hearing aid users often encounter fewer problems with CDMA compared to TDMA-based technologies does not reflect on any other aspect of the quality of service provided by non-CDMA CMRS providers.[91] It also bears noting that the worldwide GSM community has chosen to use a form of CDMA, W-CDMA, as its "third generation" technology. Thus, the problems GSM customers may be encountering today may no longer exist several years from now.

The matter, however, is far more complicated than just having different digital air interfaces generating different types of audible interference. There are numerous other variables that help determine whether a hearing aid user can use a particular digital handset without audible interference. Some of these other factors include:

B. The Hearing Loss of the Hearing Aid Wearer. The severity of one's hearing loss (*e.g.*, mild, severe, profound) has a major impact on whether one will encounter audible interference. As noted above, because hearing aids are often custom fit to the individual, even identical aids can provide different immunity and product different interference from the same handset.

C. Hearing Aid Design and Immunity. Hearing aids can be (and some are) designed to include sufficient immunity to protect users from facing any problems with digital handsets. The Center for the Study of Wireless Electromagnetic Compatibility at the University of Oklahoma

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[90] *See* ACA, *Hearing Aids & Mobile Phones: A Guide for Consumers* (Dec. 1999). One Australian carrier that operates both CDMA and GSM networks (Telstra) recommends that hearing aid wearers use CDMA rather than GSM service. *See* Telstra Media Release ("Telstra's CDMA Freedom network is an excellent replacement for the analogue network and offers significantly reduced audible buzzing for users of hearing aids over GSM Digital networks."), *available at* http://members.ozemail.com.au/~deaforum/mobile.html.

("EMC") has found a "broad range of immunity to the RF signals . . . across the different aids, with some aids yielding good immunity and others exhibiting very poor immunity."[92] Indeed, EMC tests found that the immunity levels among hearing aids varied by as much as 400% — with some aids being four times more susceptible to interference than other aids.[93] Similar wide disparities have been documented in other studies.[94] A question that must be asked is whether consumers are aware of these wide variations in immunity levels when they purchase their hearing aids.

D. Hearing Aid Style/Technology. A researcher in Gallaudet University's Technology Access Program suggests that behind-the ear hearing aids are more susceptible to interference than in-the-ear and custom canal aids because smaller aids are worn further away from the phone's antenna, are shielded by the head, and may have less gain.[95] In addition, although Sprint PCS is not aware of extensive testing, there is some evidence suggesting that newer digital hearing aids with integrated circuits are more interference resistant than hearing aids using analog circuitry.[96]

E. Handset Design. Studies have shown that hearing aid users often have better success with "flip phones" rather than "brick" handsets, due to the increased distance between the hand-

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[91] It also bears noting that digital wireless technologies (2G and 3G) also provide new means of communications (*e.g.,* SMS, email, Internet) that may be particularly attractive to hard of hearing persons.

[92] *See* Schlegel, Ravindran, Raman and Grant, *Wireless Telephone-Hearing Aid Electromagnetic Compatibility Research at the University of Oklahoma,* 12 JAAA 301, 307 (June 2001).

[93] *See Investigation of the Interaction Between CDMA Wireless Phones and Hearing Aids,* EMC Report 1999-1, at Appendix A. (March 1999).

[94] *See* Delta Acoustics & Vibration Technical Audiological Laboratory, *Comparison of Mobile Phone Electromagnetic Near Field with a Up Scaled Electromagnetic Fare Field, Using Hearing Aid as Reference,* TAL/99-AGK, at 3-4, Graphs 1 and 2 (Oct. 21, 1999).

[95] *See* Linda Kozma-Spytek, *Digital Wireless Telephones and Hearing Aids: Are They Compatible Yet?* (Dec. 2000), *available at* www.shhh.org/journalfeatart.cfm.

[96] *See, e.g., id.*

set antenna and the hearing aid.[97] One hard-of-hearing group has emphasized that handset design is "an important feature" for hearing aid users to consider:

> There are two kinds of phones: bar style (shaped like a candy bar) and flip. Flip phones, because of the location of the antenna, may be better than bar style, because the interference may be further away from your hearing aid microphone. Two people in the audience reported that they have the Samsung SCH 3500 flip phone, which is hearing aid compatible, and have experienced no interference.[98]

F. Location of Handset. The placement or location of a handset can do "a lot to improve reception":

> Holding the telephone so that a hearing aid is just a little further from a high field area can make a lot of difference.[99]

For example, one generally holds a handset over the ear. While this is the correct location for a person with an in-the-ear aid (because the center of the handset receiver is located directly over the aid's microphone), this same location does not work for a person with a behind-the-ear aid, where the microphone is located either above or behind the ear. If the user holds the handset in the normal position, with the receiver centered on the user's ear, the microphone is not receiving the best acoustic signal.

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[97] *See* Delta Acoustics & Vibration Technical Audiological Laboratory, *Comparison of Mobile Phone Electromagnetic Near Field with a Up Scaled Electromagnetic Fare Field, Using Hearing Aid as Reference,* TAL/99-AGK, at 9 (Oct. 21, 1999).

[98] *See* Northern Virginia Resource Center for Deaf and Hard of Hearing Persons, *Digital Wireless Phones/Hearing Aids* (July 2, 2001), *available at* www.nvrc/shhh_conference_10.htm.

[99] *See* Berger, *Hearing Aid and Cellular Telephone Compatibility: Working Toward Solutions,* 12 JAAA 309, 313 (June 2001).

CERTIFICATE OF SERVICE

I, Jo-Ann Monroe, do hereby certify that on this 11th day of January 2002, copies of the foregoing "Sprint PCS Comments" were served by U.S. first-class mail, postage prepaid, to:

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